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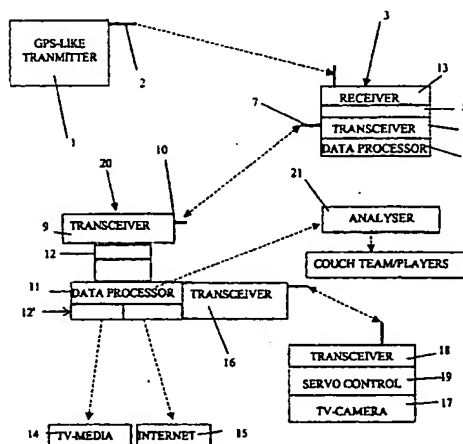
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(54) Title: **METHOD AND SYSTEM FOR PROVIDING INFORMATION FOR USE IN JUDGING A GAME AND FOR THE BENEFIT OF THE VIEWERS**



(57) Abstract: Method and system for providing information which may be used in games for judging the game according to the rules of the game and/or increasing the benefit of the viewer and observer of a reportage by provided statistics and/or visualization of events on e.g. sport arenas and utilization of the information. The system comprises a local position system including at least three transmitter units (1) for transmitting of GPS-like signals, mobile units (3) for receiving of the GPS-like signals. At least one mobile unit (3) is mounted on the sport performer and/or sport equipment. The mobile units (3) comprise a data processor (8) for processing the GPS-like signals in per se known ways to provide position parameters. Further comprise the system a central unit (20) with a data processor (11) where the position parameters transferred from the mobile units (3) being processed for further data processing, storage, controlling and/or presentation.

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METHOD AND SYSTEM FOR PROVIDING INFORMATION FOR USE IN
JUDGING A GAME AND FOR THE BENEFIT OF THE VIEWERS.

The invention concerns a method and system for integrated and interactive presentation
5 of sports events in media in order to give media, viewers, audiences and coaches more
information and insight in the performance of teams and individuals, and further
improves the quality of the referees calls through digitalization of sports events via
sensors which register the position of people and sports objects and via appropriate
software for data processing and media visualization, more specifically the invention
10 concerns a method for production of information as specified in the introduction to
claim 1 and further a system for execution of a method for providing information as
specified in the introduction to claim 6. The present invention further concerns an
application as specified in claim 12.

15 Sports reporting on radio, TV and the press have great attention in all countries. Such
reporting may be in real time or posterity. In addition to visual presentations of sports
events the reports contain information about crucial events such as, in soccer: number of
goals, who scored, time of the goal etc. Some of these data are targets for betting and
money games with huge turnover and where the profit among other things also provides
20 funding for social institutions as well as for the sports itself. Interactive TV is for time
being none existing in Norway, but available in some foreign TV channels. It is here
employed several employees sitting in the stands making notes, manually of game data
as for instance number of passes, faulty passes, shots etc. Viewers may then
subsequently call up this statistics interactively. Similarly, viewers may interactively
25 choose which manually operated camera they wish to see the game from. They may also
choose to view previous highlights if they are late starting to watch the game.

The standing and attention of a sport depends, among other things, on a perceived
fairness in uphold and execution of the rules of the game, such as for instance offside in
30 soccer. To determine if a situation is offside, the three referees in principle need to
watch two simultaneous occurrences, i.e.: determine the exact moment a pass is made to
an attacker closer to the defending teams goal and determine this attackers exact

position relative to the defending teams players at the moment the pass is made. As the sports develop and the plays become increasingly faster, teams are quicker in their collective movements and passes become longer and more precise. This increases the need for the referees to make quicker decisions and with smaller margins. The high rate of wrong call we are seeing today in soccer gives rise to controversies that is damaging for the sports status, as well as causing unfair distribution of profit for the teams, should a wrong call upset the fair result of a match and appoint the wrong winner. Methods for improved judging of offside in soccer accordingly has high priority within the responsible soccer organizations, and FIFAs target is to solve this problem within the next 10-year period. Another crucial judgment is to decide whether the ball has been over the goal line. This is again left to the referees's visual impression and may be problematic in a situation where many players are crowding the ball in the goal yard. A further situation that may sometimes be difficult is the judgment of hands.

The invention is intended to enable the production of equipment and software which may be integrated to establish, with high precision, a digital version of sports events and where the digital data through appropriate processing and presentation gives easy access to significantly more information and increases the entertainment value in sports reporting and provides coaches with more complete and significantly faster tools for analyzing sports events. In the following we are primarily referring to soccer and sports in general but the invention may of course also be used in other areas where it is desirable to acquire information about moving objects within a limited area.

The invention is further intended to enable the production of equipment and software which may be integrated to improve real-time recording of fouls, such as for instance off-side in soccer.

The invention is further intended to enable the production of equipment and software which may be integrated to give automatic guidance input and control of TV-cameras positioned around the sports arena in order for the cameras to track specified targets such as for instance a soccer ball or they may be instructed to track selected individuals.

To provide the above, it is necessary to determine the position of players and ball. It is previously known to install equipment on people or objects for the purpose of determining their position. It is thus known to make such determination using various forms of electromagnetic waves. A well established and highly successful such system is satellite navigation, GPS (Global Positioning System).

This system is developed and maintained by the US Department Of Defense (DOD) and consists of 24 satellites in orbit around planet earth sending coded signals which may be received by GPS-receivers on earth. A position assessment with an accuracy of 2-5 meters in azimuth and about twice that may be obtained using so-called differential GPS (DGPS) and by appropriate signal processing. Impressive as this may be as a global accuracy, it is still too inaccurate to decide whether a an off-side situation has occurred, or to determine whether a player has touched the ball with his head or with his left foot or with his right foot, or decide a hands or decide a goal. The GPS/DGPS inaccuracy is primarily caused by wave penetration through the ionosphere-/troposphere, deviation in the satellite's orbit parameters (ephemeris) and multi path. Higher accuracy (down to a few millimeters) is achievable, but this requires more advanced, more power consuming, heavier and more expensive receiver/antenna systems unsuited for miniature battery operation and installation on people and small objects such as for the present purpose. 5-7 years ago even the simplest GPS-receivers were too large to be considered for the present use. The last 3-4 years have however brought about a miniaturization where chip-based production technology has opened new areas of use.

This miniaturization has not focused on high precision receivers. Simpler versions are however now available in miniature format and at a reasonable cost. The GPS/DGPS system requires line of sight between receiver and satellite and can therefore not be used in-doors. The DODs ownership to the system gives them right to make the GPS-signals unavailable in emergency situations.

It is further known and described, for instance in soccer, a system for installing radio transmitters on sports players and ball and have a number of direction sensitive antennas installed around the arena to receive the transmitted signals. The players' and the balls

position are then determined by calculating the angles between transmitter and receivers. In this respect is referred to WO 93/01867. The accuracy of this method is limited mainly by the directivity of the receiver antennas and the dynamics in the measurements. It is very difficult, with antennas of practically realizable size to get a better angular accuracy than a couple of degrees. To acquire information in 3 dimensions, even this accuracy is very difficult to achieve. With base-lines in the order of 100-150 meters, the 3-D position accuracy with this system is of the same order of magnitude as that of DGPS, i.e. about 5 meters. This is insufficient for the present purpose as outlined above.

It is further known in soccer to use video-tapes for closer analysis of the performance of the team and the individual player based on records from a number of TV-cameras giving selective sectorwise coverage of the game. Such video-analyses are manual and accordingly time consuming even with aid of computers with dedicated and known software. As an example, a thorough analysis of a soccer game, performed with today's state-of-the-art technology, will take 7-8 hours for a trained individual. The analysis will only contain the parameters available from the video screen, in the limited cut out of the picture that is visible at any time. The analysis with known technology can accordingly not contain important parameters as for instance running-/walking-/jogging-distance for every player, how fast he has run, how hard he has shot, collective team movements etc.

Known equipment for the coverage guidance and control of TV/video cameras during recording of sports events is manual. This makes it difficult to have close-ups recordings and at the same time quickly turn the camera to follow the ball and the movements of the play. This requires several operating personnel and several cameras.

Known methods to detect and register offside has the inherent weakness that they are based on the referees' visual impressions and the decisions are consequently very often inaccurate and controversial. In order to determine an offside the referees must in principle observe two simultaneous events: it must be observed the exact moment a player makes a pass to a fellow team mate attacker closer to the defending teams goal

and the exact position of this attacker relative to the defending teams players at the moment the ball is played

The time required for the referee to shift the focus of his attention from the position where the ball is passed to where it is to be received is sufficient for the relative position between attacker and defender to have changed with more than 5 meters in the meantime. It is further known to use various forms of visual markings to assist in the judgment of offside. Such visual aids may be cross-field markings or focused light beams near the ground. These systems do not attribute to an improved analysis of the game neither do they contribute significantly to ensure the quality offside calls since the main problem for the referees is of a dynamic nature: to judge the simultaneous occurrence of a pass in one location of the arena and the position of players in another location on the arena. The known visually based systems have marginal ability to assist with this dynamics.

The intention of the present invention is to devise a provide a methode and a system for execution of the methode for integrated and interactive presentation of sports events on the media to overcome the weaknesses as described for known systems, so that determination of position for sports players and objects may be achieved with equipment having lower weight and an order of magnitude higher precision than known miniature DGPS-systems or known radio wave based goniometric systems and so that such position determination may be achieved not only outdoors as is known with the present DGPS systems but also on in-door arenas in such a way that the access to satellite signals, as with GPS, is no longer a limiting factor and that such equipment is integrated with software to enable data processing and presentation of game analysis in near real-time encompassing significantly more parameters contrary to known systems which require 7-8 hours of processing and so that corresponding parameters may be integrated and visualized interactively in media such as TV, Internet and analysis software for coaches in real-time as well as post game analysis

The intention of the present invention is achieved by a method and a system of the kind as described in the introduction and which characteristic features are apparent from

Claim 1 and 6. Further features of the present invention are apparent from the remaining, dependent Claims.

The present invention employs the best from the most modern positioning technology (DGPS) have today, but replaces the satellites with a number of local transmitters at the sports arena. The transmitters send GPS-like signals that are captured by receivers, functioning after the same principle as modern GPS-receivers. The receivers may be fixed on the arena and the transmitters may be installed on the sports players and objects. Or alternatively vice versa. The mobile units contain one or more receivers each integrated with its radio transmitter reporting position back to a central unit on the arena, where a processor in each fixed transmitter and a miniature processor integrated in each mobile unit communicate via radio-transceiver with a more powerful processor in a central unit. The central units data processor has software, which among other things may calculate a more exact position based on the information from the network of stationary transmitters and mobile receivers. In this way is position accuracy improved corresponding in principle to a so-called inverse GPS in a standard DGPS-system.

The fixed stationary GPS-like transmitters may also, in addition to their primary function, assume the role of reference stations in a standard DGPS-system, thereby eliminating the need for additional reference stations to achieve DGPS-quality. In the preceding description it is assumed that the transmitters of GPS-like signals are stationary and that the receiver unit for these signals are installed on sports players and objects. The described utilization of the inventions DGPS-like technology in sports applications is however also achievable after the opposite principle; i.e. the transmitters of GPS-like signals are installed on sports players and objects, and the receivers for these signals are fixed installed on the sports arena.

The described network of transmitters and receivers is operated in a similar way as a GPS-system but instead of operating in the regular GPS band around 1.5 GHz, the system according to the invention operates in frequency bands which are generally free on a global basis (f. ex. 2,4 GHz) assuming transmitted power less than 100 mW. The

same band is used in the necessary radio communication in the network consisting of the central unit and the fixed and mobile units. Use of this higher frequency band further facilitates the use of smaller antennas; an important factor for the design of the mobile units where weight and volume of the equipment is critical and must be miniaturized without jeopardizing accuracy and integrity. Further, possible conflict and interference with the 1.5 GHz GPS-band is avoided.

The procedure and system according to the invention have a number of advantages: The proposed GPS-like technology to be used in transmitters/receivers ensures that we take advantage of the advances in the most accurate of known positioning systems: DGPS. We are improving further on its accuracy by removing the DGPS systems most significant error sources; i.e. those due to signal penetration of ionosphere/troposphere and uncertainty in determining the exact satellite orbit parameters. Also multi-path-error is reduced with the local area operation avoiding the long signal path from space, since percentual differences of direct and reflected waves becomes bigger and therefore easier to eliminate in software. Further, signal/noise ratio is greatly increased and optimal geometry is assured when defining the intersection point for the lines between the GPS-like transmitters and the receivers (i.e. low DOP-value in GPS terminology). Through this, dynamic decimeter-accuracy is achieved with simple receivers operating after the GPS-principle. This is 20 to 50 times better than other known systems of a similar size and for similar application. Decimeter accuracy is otherwise only achieved in GPS-systems based on 2-frequency technology, which is power consuming, heavy and expensive. The execution according to the invention makes use of miniaturized equipment for the mobile units weighing less than 20 gram, which is less than 10% of a 2-frequency receiver and costs in the order of 5% of a 2-frequency receiver. It is a condition in order to achieve the specified dynamic accuracy that positions may be sampled with minimum 20 Hz in sports with rapid movements such as soccer.

As the equipment becomes so light and yet so accurate, several units may be installed on each player in order to cover the need for information from the different body parts. In soccer for instances 3-5 units per player may be installed, one on each leg/foot (to register which leg was used in a shot or pass), one on the head area (to see if the player

headed) and possibly one on each arm (to register hands). In addition to this, a similar unit is installed on the ball or other sports objects. All report signals to the central unit may be encrypted to prevent pirate listening at the arena. The signal strength is so low that the signals will be undetectable beyond a couple of hundred meters from the arena.

5 Emitted energy is so low that there is no danger of hazardous radiation for the players and the audience. Necessary effect is, for the sake of comparison, 1-10% of a cellular phone.

The huge reduction in distance between transmitters and receivers as compared to a traditional GPS system results in a much higher signal/noise-ratio compared with

10 traditional GPS, even though radiated power are lower. This, and the increased frequency, simplifies antenna design. The antennas for the GPS-like signals as well as the radio signals may be integrated with the players clothing and and/or protective equipment and/or sports objects. A unit will be installed inside the ball with the

15 antenna(s) distributed and attached inside as appropriate.

No other known technology is accurate enough for the detailed logging of body movements and ball as described in the present invention. This accuracy is however necessary in order for the system to report for example offside and hands.

20 The positions are sampled at a optional rate up to at least 20 Hz. In order to reduce the amount of transferred data to the central unit software may be applied to integrated processor of the mobile units, which from the change of position of the last sample estimate the need of reporting the position to the central unit. For example if the player

25 stands still, fewer data may be transmitted than when he runs.

Software is installed on the central unit to perform a number of necessary functions. In the first step position data is read. These data are received via radio signals from the GPS-like, fixed transmitters and mobile units in a receiver on the central unit. The radio

30 receiver may be connected to for example the RS-232 port of the central units. The software for reading the incoming data may be written in a known protocol format such as for example TestPoint or LabView. In the next step position accuracy may improved

by for example using known software similar to that which is used in inverse DGPS calculation. This position improvement may however alternatively be done in the on-board processor on the mobile units. For use within soccer for example, it is necessary to decide if a player has touched the ball and with which foot or head. This may be
5 determined in software by judging the momentary distances between ball and body parts and the balls acceleration. This determination may be done in software exclusively by position data input, or in combination with input to the central unit from sensors reporting ball acceleration. It may be used the same type of radio transmitter and frequency band as the one used for the position determination.

10 In the preceding has been described a method and a system for providing of information which may be used in a game to judge the game in accordance with the rules of the game, and/or to increase viewers and observers interest and fascination by offering statistics and/or visualization of events such as from a sports arena. The registered
15 positions may also however be used for visualization in a virtual environment as specified in claim 12.

One intention with these additional features is to provide an opportunity to show a new and more realistic interaction between living creatures, primarily humans, and virtual
20 environments. Each of the sensors may to a certain extent be described as functional development of the data-mouse. While the mouse represents a one-sided two-dimensional interface between human and data program, the sensor system represents a dramatically expanded 3-dimensional and multi faceted interface.

25 In the following the invention is described in further detail with reference to the drawings where:

Fig. 1 shows a schematic block diagram of the system according to the present invention.

With reference to fig 1, the system is shown as an example for use in soccer without thereby limiting the use to exclude also other sports applications. The fundamental functioning of the procedure according to the invention may be the same.

5 The main elements in the equipment is a number of transmitters 1 (for example 4) sending GPS-like signals in the 2.4 GHz band. The transmitters have antennas 2 fixed in exact surveyed positions at the arena. Further a number of mobile units 3 with receivers 13 for the GPS-like signals are installed on players and ball. For example 3 such receivers 13 with antennas 4 and batteries 5 may for example be mounted on each
10 player and one on the ball. The transmitter 6 with antenna 7 in the mobile unit 3 may be a radio transceiver for approximately the same frequency band as indicated above and be connected with a miniature data processor 8.

In the use of transceivers, to-way communication may be performed between fixed units
15 1, mobile units 3 and central unit 20 so that data from the mobile units 3 are processed in the data processor 8 for determining for example position parameters before these data are transferred to the central unit 20 and possible signals are sent from the central unit 20 to the mobile units 3 for acquisition of such and other information. Subsequent correction of position data from the mobile units 3 and position data from the fixed units
20 1 may be done in a data processor 11 in the central unit 20. Antennas 4 and 7 may be combined in one.

The central unit 20 is installed in an appropriate place on the arena for reception of GPS-like data (position and other relevant parameters) from the fixed and mobile units
25 3 via integrated transceiver or transmitter 6. The central unit 20 receives these data through a multi channel radio transceiver 9 via an antenna 10. The central unit's 20 transceiver 9 may have output facilities connected to appropriate data input facilities 12, for example RS-232 port, on the central unit, possibly via a multiplexer whereupon the data are read into the data processor 11 for further processing, storage and presentation.

30

From the central unit 20 processed data, in the form of statistics, visualisations etc, be transferred to media such as for example TV 14 for integration in TV-broadcasts

visualized in an appropriate form and overlaid the TV-images. With interactive TV, the viewer may do the various statistics and visualizations interactively.

Further, similar data may be transferred from the central unit 20 to Internet 15 where appropriate visualizations and statistics may be made available.

Further, data from the central unit 20 may be used as basic parameters for analysis program 21, which visualizes the required parameters for coaches and players.

Further, data from the central unit, using dedicated software, may form the basis in a digital visual presentation of players and ball in a 3-dimensional environment in order to provide total coverage of the game over the whole arena and with optional angle of view. This is an improvement over today's technology, which allows only sector coverage assuming a reasonable number of TV-cameras.

Further, data from the central unit, using dedicated software, may form the basis for a simulation of alternative game proceedings with a starting point in any chosen registered situation or event.

Further, the central unit, using dedicated software, may via a transceiver 16, give guidance information to cameras 17 with radio transceiver 18, camera sight and servo control 19 so that the cameras may be automatically guided, using position data, to track chosen events, individuals or objects. In soccer one may typically choose to track the ball since this is the center of focus for the game. Criteria for zoom and interactive choice of which camera one wishes to project (if there are several) may be a software feature. With interactive TV, the viewers may do such choice of camera interactively.

In the preceding has been described a system for providing information which may be used in a game to judge the game in accordance with the rules of the game, and/or to increase viewers and observers interest and fascination by offering statistics and/or visualization of events such as from a sports arena. In the following a further possibility is going to be described with visualization and use by applying the determination of position according to the invention.

One intention with these additional features is to provide an opportunity to show a new and more realistic interaction between living creatures, primarily humans, and virtual environments created in software. Each of the sensors may to a certain extent be described as functional development of the data-mouse. While the mouse represents a one-sided two-dimensional interface between human and data program, the sensor system represents a dramatically expanded 3-dimensional and multi faceted interface.

This is achieved by installation of miniature sensors (of the kind described in the preceding) on people's hands/fingers/torso/limbs. The sensors may primarily register the exact position of the limbs in a 3 dimensional environment, but also register other data such as pulse, temperature, level of stress etc and report this to stationary receivers in a system of the kind mentioned in the preceding.

The virtual environment may contain creatures, objects and surroundings, generated on a data processor by 2D/3D-graphics and visualized on a suitable monitor. Some specific applications are described in the following:

a. Virtual Studios

It is known to use a neutral physical background (for example blue) during recording and broadcasts in studio for subsequent overlay of a virtual background and props generated and visualized with computer graphics. This graphics is seen by the TV viewers but not in the studio. Since the people participating in the broadcasts do not see the graphics directly (except on a TV-monitor in the studio) people and cameras are placed in predetermined positions in order to fit together with the created virtual elements. One example is TV weather forecasts where the forecaster does not see the background map but indicate to map locations with hand movements by experience and side looks on a TV monitor in the studio.

The present invention may be used to significantly improve today's system. In a confined location like a studio, the sensors are expected to have position accuracy better than 1 cm (compared to 10 cm on a sports arena). Placing high precision position

sensors on cameras and people (torso/hands/feet) and having receivers installed in the studio according to the invention as described, makes it possible to integrate virtual objects and physical people in the picture which is visualized on the monitor, and which may be transmitted to the viewers, in a manner which is much more flexible and advanced than today. The participants will have full freedom of movement within their surroundings and not be bound to designated positions as the case is today. Further, objects and props may be integrated in a way that has so far not been possible

In combination with computer graphics one may for example:

- Place a virtual object, generated by means of 3D-graphics, in the hand of a person since information is made available by sensors on fingers/hands about their exact x,y,z positions. Two or more persons equipped with such sensors may then perform interactions in a virtual environment. Among typical objects that may be integrated with a person's hand are: sports object (tennis racket, boxing gloves, ball etc), musical instruments (piano, drums, etc), medical/surgical instruments etc. With these virtual objects, people may carry out corresponding actions such as:

- "Surgery" on virtual people created by 3D-graphics. "The surgeon" has sensors on his fingers/hands and may see his virtual patient and his own hands on a monitor

- "Game-shows" and computer games where the participants compete in reaction or motoric inspired competitions. This may be to catch or manipulate virtual objects with their hands. The participants carry sensors on their fingers/hands and relate to virtual objects as they are seen on a monitor, where they also see themselves.

Wide ranges of other applications are of course possible in a studio environment; within entertainment as well as education.

b. Virtual Sports arenas

Various forms of computer games are known and exist where, using a mouse or other physical interface, interaction is possible between the player in front of the computer and virtual objects on the computer screen.

5

Such games may with the system according to the present invention gain new realism and new applications as the player in his home environment carries sensors on his hands/feet/head/torso and alternatively, but not necessarily, sensors are attached to sports objects as a tennis racket etc. depending on what may be relevant for the game in question. The signals from the sensors are communicated to, and processed in, a computer according to the present invention where they are integrated into the appropriate game software. This assumes a priori surveying of a position network in the player's home environment. A wide range of sports relations may be carried out in this application according to the invention, such as:

15

- Generating game situations where the player in front of the monitor or super screen/ projector may attempt to return a serve from Pete Sampras, play as an attacker during for Manchester United, make a ski jump in Oberstdorf, etc. The players carry sensors as appropriate for the sport in question and relate to virtual objects as they are seen on the monitor. The relations may also be carried out via Internet.

20

c. Virtual advertisement

It is known to install advertisement board around sports arenas so that TV viewers and spectators may read their advertisement message. Such boards and posters may be mechanically rotated to show for example 3 different advertisements sequentially in the same arena location. It is further known to overlay computer generated virtual advertisement at agreed spots on the sports arena. This overlaid advertisements is not seen by the spectators, but will be seen by TV viewers.

30

This concept may be significantly improved with the aid of the system according to the present invention, as this makes it possible to interconnect the objects or symbols on the advertisement and peoples or animals limbs.

- 5 - Generate virtual advertisement where the advertisements objects, products or symbols may be integrated with people and/animals.

The advertisement may in a known manner be animated. It may further be made selectively available, for instance with relation to language, and distributed
10 selectively on a geographic basis.

2. Spotlights and cameras

In the preceding, automatic guidance of cameras in a sports arena is described. This principle according to the present invention may also be applied for example stage
15 shows, studio recordings, or other forms of performances and in addition to cameras also include spotlights.

C l a i m s

1.

A method for production of information which may be used for example in a game to
5 judge the game in accordance with the rules of the game, and/or to increase viewers and
observers interest and fascination by for example broadcasts through offering statistics
and/or visualization of events such as from a sports arena,
c h a r a c t e r i z e d b y
that in a local positioning system comprising at least 3 transmitter units (1) are
10 generated and transmitted GPS-like signals,
that the GPS-like signals are received by mobile units (3), where at least one mobile
unit (3) is installed on sports players and/or sports objects, or that the mobile units
generate and transmit GPS-like signals, which are received by at least 3 fixed receivers,
that the GPS-like signals are processed in data processors (11) in the mobile units (3) or
15 the fixed units to provide, in a generally known way, position parameters for those parts
of a sports players body with relevant extremities, and that the provided position
parameters are sent from the mobile units (3) or the fixed receivers to a central unit (20)
where a data processor (11) performs further data processing, storage and/or
presentation.

20

2.

Method according to claim 1, c h a r a c t e r i z e d b y
that the central unit (20) transmits the mobile units (3) position in the form of guidance
signals to a servo device (19) in one or more cameras (17) for automatic tracking of
25 objects such as for example the ball in soccer.

3.

Method according to any of the aforementioned claims,
c h a r a c t e r i z e d b y that the parameters from the data
30 processor (11) in the central unit (20) are used for real-time- and/or post-integration in
TV-broadcasts for visualization in appropriate form and/or overlaid a TV-picture/frame
(14) in an appropriate way, possibly in an interactive environment, and/or the data are

further processed for presentation on Internet (15) and/or the data are further processed in analysis software (21) for presentation in appropriate form to coaches/players, and/or processed data are transferred in real-time in an appropriate form, for example as an audio signal, to the referee as a help in judging a possible offense against the rules of the game such as for example offside in soccer.

4.

Method according to any of the aforementioned claims,

c h a r a c t e r i z e d b y that the parameters from the data processor (11) in the central unit (20) with appropriate software are used for visualization in an appropriate form of players and ball in a 3-dimentional environment for total coverage of the match over the whole arena, and with selectable viewing angles.

5.

Method according to any of the aforementioned claims,

c h a r a c t e r i z e d b y that the parameters from the data processor (11) in the central unit (20) with appropriate software are used for simulation and visualization in appropriate form of alternative match proceedings with basis in any chosen match situation.

6.

System for execution of the method to produce information, which may be used for example in a game to judge the game in accordance with the rules of the game, and/or to increase viewers and observers interest and fascination by for example broadcasts through offering statistics and/or visualization of events such as from a sports arena.

c h a r a c t e r i z e d b y that a local positioning system is provided comprising at least 3 transmitter units (1) generating and transmitting GPS-like signals, that the GPS-like signals are received by mobile units (3), where at least one mobile unit (3) is installed on sports players and/or sports objects, or that the mobile

units generate and transmit GPS-like signals, which are received by at least 3 fixed receivers,

that the GPS-like signals are processed in data processors (11) in the mobile units (3) or the fixed units to produce, in a generally known way, position parameters for those parts of a sports players body with relevant extremities, and that the produced position parameters are sent from the mobile units (3) or the fixed receivers to a central unit (20) where a data processor (11) performs further data processing, storage and/or presentation.

10 7.

System according to claim 6, c h a r a c t e r i z e d b y that each mobile unit (3) with receivers for GPS-like signals have a receiver antenna (4), and a transceiver (6) with a transmit antenna (7), and that the data processor (8) in the mobile unit (3) is equipped for processing of the GPS-like signals so that data strings containing among other things position reports may be transmitted to the central units (20) radio receiver (9) with a data rate for example depending on the speed and acceleration of the mobile units (3) and that this data rate may be chosen from 0 to minimum 20 Hz by intelligent software residing in each mobile units (3) data processor.

20 8.

System according to claims 6-7, c h a r a c t e r i z e d b y that the central units (20) data processor (11) is equipped to acquire, process, store and present the incoming digital data in a way and in a format suitable and compatible for TV-media (14) for real time- and/or post- processing in TV-broadcasts visualized in an appropriate form and superposed on the TV-pictures in an appropriate way, and to real-time transfer to the referee in an appropriate way to determine offense against the rules of the game such as for example off-side in soccer.

9.

30 System according to claims 6-8, c h a r a c t e r i z e b y that the central units (20) data processor (11) processes said data in such a way and in such a form that the central unit (20) via a transceiver (16) connected with the data processor

(11) communicates the position coordinates of objects to a servo device (19) via transceiver (18) on strategically placed TV-cameras (17) for automatic tracking of objects such as for example the ball in soccer.

5 10.

System according to claims 6-9, c h a r a c t e r i z e d b y that the batteries (5) supplying energy to the mobile units (3) gets its charging energy through the use of motion energy from the players body motions.

10 11.

System according to claims 6-10, c h a r a c t e r i z e d b y that the mobile units (3) are made to be built into the players clothing and sports equipment such as shoes/boots, shin protectors, helmets and other protective gear, and/or that they are built into special bands or strips attached to or around body parts such as for
15 example legs and/or arms and/or head region, and/or that they are built into sports objects such as a ball, puck, golf club, ice hockey club, bandy club, ski, poles, skates, or similar.

12.

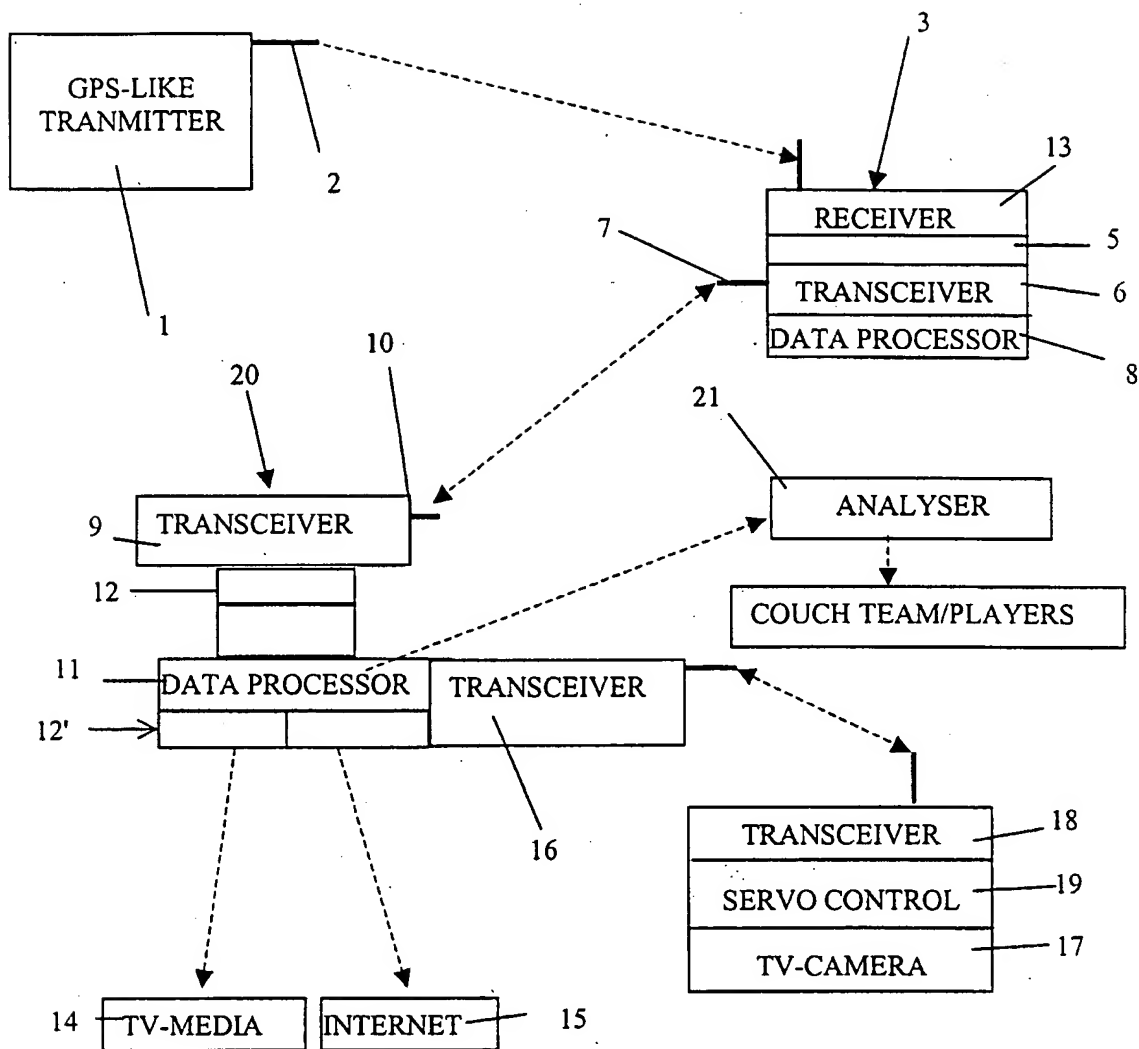
20 Use of a local positioning system consisting of at least 3 transmitter units (1) generating and transmitting GPS-like signals, where the GPS-like signals are received by mobile units (3), where at least one mobile unit (3) is installed on participants in TV-broadcasts and/or corresponding objects, or that the mobile units generate and transmit GPS-like signals, which are received by at least 3 fixed receivers, where the GPS-like signals are
25 processed in data processors (11) in the mobile units (3) or the fixed units to produce, in a generally known way, position parameters for those parts of a participants body with relevant extremities, and that the produced position parameters are sent from the mobile units (3) or the fixed receivers to a central unit (20) where a data processor (11) performs further data processing, storage and/or presentation and determination of said
30 persons extremities in relation to other extremities and surroundings in order to attach virtual objects or surroundings to said positions for physical persons body and extremities in the image which is visualized on a display unit so that the virtual objects

or surroundings follow the participants'/extremities' movements without being bound to designated positions.

13.

- 5 Use of a local positioning system according to claim 12 where the central units (20) data processor (11) processes the said data in such a way and in such a format that the central unit (20) via a transceiver (16) connected to the data processor (11) transfers position coordinates for objects and persons with extremities to a suitable guidance unit such as for example a servo device (19), via transceiver (18) on strategically positioned TV-
- 10 cameras (17) or spot-lights for automatic tracking of persons and objects.

1/1

**Fig. 1**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 00/00259

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A63B 71/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9953339 A1 (ORAD HI-TEC SYSTEMS LIMITED), 21 October 1999 (21.10.99), page 2 - page 4, the figure; the claims --	1-2,6-7, 11-13
X	WO 9837932 A1 (TRAKUS, INC.), 3 Sept 1998 (03.09.98), page 5 - page 7, the claims and figures --	1-4,6-9, 11-13
X	WO 9510337 A1 (KLEIN, T.), 20 April 1995 (20.04.95), page 1 - page 3, figures 1-2, the claims --	1-2,6-7, 11-13

☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 00/00259

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5513854 A (G.J.G. DAVER), 7 May 1996 (07.05.96), column 1 - column 4; column 10 - column 12 --	1-4,6-9, 11-13
A	FR 2753633 A1 (VIENNOT EMMANUEL FRANCOIS ANDRE), 27 March 1998 (27.03.98) --	1-13
A	FR 2726370 A1 (VALLORTIGARA, A.), 3 May 1996 (03.05.96) -- -----	1-13

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/NO 00/00259

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WO	9510337	A1	20/04/95	FR	2711069 A	21/04/95
US	5513854	A	07/05/96	NONE		
FR	2753633	A1	27/03/98	NONE		
FR	2726370	A1	03/05/96	NONE		